INDIAN JOURNAL OF SCIENCE AND TECHNOLOGY

ORIGINAL ARTICLE

Prevalence of Glenohumeral Internal Rotation Deficit in Recreational Bowlers in Belagavi City: An Observational Study

Basavaraj Motimath[1]*, Sanjiv Kumar[1]

1 KAHER Institute of Physiotherapy Belgaum, Karnataka, India

OPEN ACCESS

Received: 02/01/2025

Accepted: 05/05/2025

Published: 10/06/2025

Citation: Motimath B, Kumar S (2025) Prevalence of Glenohumeral Internal Rotation Deficit in Recreational Bowlers in Belagavi City: An Observational Study. Indian Journal of Science and Technology 18(22): 1763-1767. https://doi.org/10.17485/IJST/v18i22.10

* **Corresponding author**.

bsmotimath@yahoo.co.in

Funding: None

Competing Interests: None

Published By Indian Society for Education and Environment (iSee)

ISSN
Print: 0974-6846
Electronic: 0974-5645

Abstract

Objective: To assess the prevalence of Glenohumeral Internal Rotation (GIRD) deficit in recreational Bowlers. **Methods:** This observational study consisted of recreational cricketers (18-25 years) from various cricket academies and cricket clubs in Belagavi city. The GIRD was measured with a goniometer. Both the dominant and non-dominant shoulder were assessed and compared to measure GIRD. This study involved 93 bowlers, predominantly male (90%), aged between 18 and 25 years. **Findings:** A positive linear association was found between GIRD and age $(r = 0.369, p = 0.001)$, as well as between GIRD and years of experience $(r = 0.263, p = 0.011)$, indicating that both increasing age and greater experience are associated with a higher likelihood of developing GIRD in bowlers. The study concluded that the prevalence of GIRD amongst cricket bowlers is 37%. The study highlights a significant prevalence of GIRD among bowlers, particularly as they age and gain experience. **Novelty:** The study's findings highlight the importance of implementing targeted strategies to preserve shoulder function and prevent injury.

Keywords: Cricket; Bowlers; GIRD; Shoulder injury; Glenohumeral internal rotation deficit

1 Introduction

Cricket is a popular sport that calls for a blend of talent, physical fitness, and strategic thinking. Cricket players are particularly vulnerable to overuse and impact injuries, especially in the shoulder, because of the frequent overhead motions required for bowling and throwing. Cricket players, especially bowlers, subject their shoulders to significant loads due to repetitive overhead motions. These actions generate rotational, compressive, and shear forces on the shoulder joint, particularly stressing the rotator cuff and surrounding muscles. Over time, this can lead to injuries like tendinitis, rotator cuff tears, and labral damage.[(1)]

GIRD, a condition marked by a considerable decrease in the dominant shoulder's internal rotation (IR) range of motion relative to the non-dominant side, is one of the most common adaptations observed in athletes who throw overhead. A loss of more

than 20° of internal rotation with respect to the contralateral shoulder is currently considered GIRD.[1]

Overhead sportsmen commonly acquire GIRD as a result of the repeated nature of throwing in sports like cricket, which alters shoulder flexibility and mobility. The glenohumeral joint's total range of motion becomes unbalanced as a result of this disorder, which usually causes decreased internal rotation and greater external rotation[2]. The likelihood of shoulder problems such as rotator cuff tears, labral injury, and impingement syndromes is greatly increased over time by these biomechanical adaptations, scapular dyskinesis, and muscle imbalances[3].

While many studies have examined shoulder adaptations and injury mechanisms in overhead athletes, much of the research has been centered around baseball pitchers and other throwing sports. However, there is limited information on how GIRD (GIRD) affects cricket bowlers, particularly those at the recreational level. Most available studies focus on elite and professional players, overlooking the fact that recreational cricketers are increasing in number and may also be at risk of shoulder dysfunction[4]. Thus, this study aims to find the prevalence of GIRD in recreational bowlers.

2 Methodology

This observational study included 93 recreational cricket players recruited from various cricket clubs and academies. Participants were between 18 and 25 years old and comprised both spin and pace bowlers. Players were excluded if they had any symptomatic musculoskeletal injuries in the past six months that restricted their ability to play or if they had any neuromuscular or cardiovascular conditions.

The study was conducted following ethical approval from the Institutional Ethics Board. The study was registered under Clinical Trial Registry of India with the reference number CTRI/2024/09/073748. Before participation, all subjects were informed about the purpose and procedures of the study, and written informed consent was obtained.

GIRD was assessed using a goniometer to measure internal rotation range of motion. Patients were positioned supine with the shoulder abducted to 90 degrees and the elbow flexed to 90 degrees, ensuring the humerus was supported on the examination table. The goniometer axis was aligned over the olecranon process of the ulna, with the stationary arm perpendicular to the floor and the movement arm aligned with the ulnar side of the forearm. Patients were then instructed to internally rotate their shoulder by moving their palm downward toward the floor, while ensuring that the motion occurred solely at the shoulder joint without compensatory movements from the scapula or trunk. At the end range of internal rotation, the measurement on the goniometer was taken. The expected range of motion for internal rotation was typically between 0 to 70 degrees. To ensure the measurement reflected isolated glenohumeral internal rotation, the examiner palpated the coracoid process and monitored for any scapular or thoracic compensatory movements throughout the motion. The scapula was manually stabilized when necessary to prevent anterior tilting or rotation.[4],[5]

Each participant underwent three separate measurements, and the average value was recorded. GIRD was calculated by subtracting the internal rotation range of the dominant shoulder from that of the non-dominant shoulder.

2.1 Statistical Analysis

The data were statistically analyzed by SPSS version 23 software. The normality of data was tested through the Shapiro Wilk test. The prevalence of GIRD was calculated through prevalence analysis. Karl Pearson correlation was done to find the correlation between GIRD and age, days of practice and years of experience. Probability values of <0.005 were considered significant

3 Results and Discussion

3.1 Prevalence of GIRD

Among the 93 bowlers of which 40 bowlers were left hand bowlers and 53 were right hand bowlers, of these 57 bowlers were medium passed and 36 were fast bowlers. Among these bowlers 37% $(n = 34)$ exhibited a GIRD of 20° or more, confirming a significant prevalence of the condition. The remaining 63% $(n = 59)$ had a GIRD score of less than 20°, suggesting that while not all bowlers experience significant internal rotation deficits, a considerable number do (Table 1, Figure 1).

Table 1. The distribution of GIRD scores and their prevalence among participants

GIRD Score	Frequency	Prevalence Rate
< 20	59	63%
>= 20	34	37%

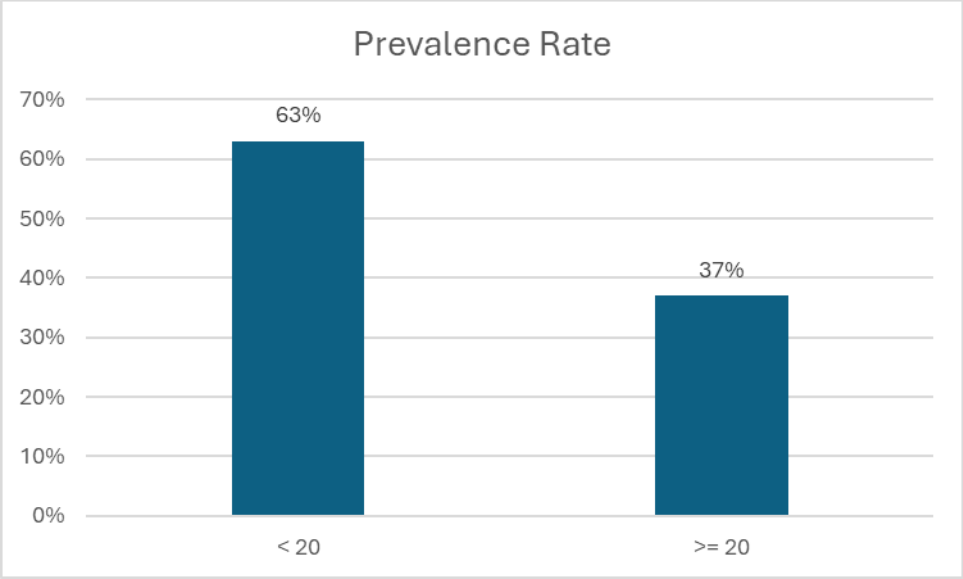

Fig 1. The GIRD prevalence

3.2 GIRD and Age

A statistically significant positive correlation was observed between GIRD and age $(r = 0.369, p = 0.001)$, indicating that older bowlers exhibited greater degrees of internal rotation deficit (Table 2).

3.3 GIRD and Years of Experience

A positive correlation was observed between GIRD and years of experience $(r = 0.263, p = 0.011)$, reinforcing the idea that bowlers with more experience are at a higher risk of developing shoulder mobility restrictions (Table 2).

3.4 GIRD and Weekly Practice Frequency

No significant correlation was found between GIRD and the number of practice days per week $(r = -0.072, p = 0.492)$, indicating that practice frequency alone does not appear to contribute significantly to the development of GIRD (Table 2).

Table 2. The relation between the age, days of practice and years of experience with with p value <0.05*

	Variable	r-value	p-value
	Age	0.369**	0.001*
	Days of Practice	-0.072	0.492
GIRD	Years of Experience	0.263*	0.011*

4 Discussion

The findings of this study provide valuable insights into the prevalence of GIRD among recreational cricket bowlers. A significant proportion of bowlers exhibited GIRD, with 37% of participants having a deficit of 20° or more. This indicates that a substantial number of bowlers experience reduced shoulder mobility, which can lead to functional limitations and increased injury risk over time.

The findings of this study can be contrasted with those of Standoli et al. (2024), who examined the prevalence of GIRD in elite swimmers. Their study identified GIRD in 18.1% of participants, significantly lower than the 37% prevalence observed in cricket bowlers in the current study. The disparity in GIRD prevalence between the two groups could be attributed to the fundamental differences in shoulder biomechanics and training adaptations between swimming and bowling. It should also be considered that swimming is a bilateral activity involving both shoulders symmetrically, which may promote balanced muscle development and joint mobility. In contrast, cricket bowling is a unilateral, high-intensity repetitive action that predominantly loads one shoulder, potentially increasing the risk of asymmetrical adaptations and the development of GIRD. [6]

A clear positive correlation between GIRD and age was observed, showing that older bowlers tend to have greater internal rotation deficits. This suggests that prolonged exposure to overhead bowling motions contributes to cumulative stress on the shoulder joint, leading to adaptive changes such as posterior capsule tightness and altered scapular movement patterns. Similarly, a positive correlation between GIRD and years of experience highlights that the longer an individual has been bowling, the more likely they are to develop shoulder mobility restrictions. These findings align with research conducted on other overhead athletes, such as baseball pitchers and volleyball players, where repetitive high velocity throwing motions have been shown to result in gradual changes to the shoulder's range of motion over time. [7], [8]

Kalo et al. investigated youth tennis athletes assessing the relationship between training history and GIRD. Their findings indicated that years of tennis training correlated significantly with internal rotation asymmetry, but age itself was not a significant factor in shoulder mobility changes. He also found that days of practice per week (4–6 days) were not a significant factor in the development of GIRD among youth tennis players. Instead, their study indicated that the total years of practice played a more crucial role in shoulder mobility adaptations. Despite high weekly training frequency, no direct correlation was observed between training volume (hours per week) or days of practice and internal rotation loss. [9]

The results of this study can be contrasted with the findings of Perumal et al., who investigated GIRD in professional fast bowlers and its correlation with bowling speed. Unlike the present study, which found a high prevalence of GIRD, Perumal et al. reported that none of the fast bowlers in their sample met the clinical threshold for GIRD. The difference in findings could be attributed to several key factors, including the level of play (professional vs. recreational), training intensity, and biomechanical variations between fast bowling and recreational bowling [10].

Doyscher et al. examined GIRD in elite gymnasts and its impact on shoulder function. Their study found that gymnasts developed bilateral GIRD, whereas the present study identified unilateral GIRD in cricket bowlers, predominantly in the dominant arm. This difference likely arises due to the distinct biomechanical demands of each sport. While cricket bowlers rely on high-velocity, unilateral throwing motions, gymnasts experience repetitive overhead loading on both shoulders, which results in symmetrical internal rotation deficits. [11]

The findings of this study align with those of Olivier et al., who examined asymmetries in shoulder range of motion and their role in cricket-related injuries. Their study found that shoulder Internal Rotation differences greater than 10° were associated with a higher risk of injury during the cricket season. Similarly, our study observed a notable difference between the dominant and non-dominant shoulder Internal rotation, supporting the notion that repetitive overhead movements in cricket result in long-term shoulder adaptations and mobility imbalances [12]. However, unlike Olivier et al, who focused on elite provincial and club cricketers, this study targeted recreational players, who may not have access to structured rehabilitation and injury prevention programs. This difference may explain why a higher prevalence.

Interestingly, no significant correlation was found between GIRD and the number of practice days per week. This suggests that training frequency alone does not directly contribute to the development of GIRD, and that the cumulative effect of years of bowling and repetitive movement patterns plays a more significant role. [13] However, the results from this study indicate that it is not just the intensity of training but rather the duration of exposure to bowling over multiple years that has a greater impact on shoulder mobility.

4.1 Future Scope

Future research should focus on long-term tracking of GIRD progression in cricket bowlers to determine its impact on performance and injury risk. Comparing recreational and professional players can help identify whether training load, biomechanics, or recovery strategies influence GIRD severity. Developing cricket-specific screening and rehabilitation programs will be crucial in preventing shoulder injuries. Additionally, gender-specific research is needed to explore differences in shoulder adaptations among male and female cricketers. A deeper understanding of GIRD's impact on bowling efficiency, endurance, and accuracy will allow for better training protocols and long-term athlete development. Implementing structured mobility and strengthening programs tailored to cricket-specific demands can help bowlers maintain optimal shoulder function and prevent performance limitations. Future research should also focus on longitudinal studies to track GIRD progression over time, compare findings between recreational and professional players, and assess the effectiveness of corrective exercise

protocols, plyometric training and scapular exercises. By addressing these gaps, cricket players can benefit from targeted injury prevention strategies, ultimately improving their longevity and efficiency in the sport. While the number of practice days per week was recorded, specific measures of bowling or throwing load such as the number of deliveries, intensity, or duration were not captured in this study. Given the physical demands and repetitive nature of bowling in cricket, future studies should incorporate detailed workload metrics to better understand their impact on recovery, performance, and injury prevention.

5 Conclusion

This study highlights the prevalence of GIRD among recreational cricket bowlers, revealing that a significant proportion of players experience reduced internal rotation in their dominant shoulder. The findings suggest that age and years of experience are key factors contributing to the development of GIRD, as prolonged exposure to repetitive overhead bowling motions leads to structural adaptations in the shoulder joint.

Given these findings, there is a clear need for routine screening and preventive interventions to minimize the long-term effects of GIRD in cricket bowlers.

6 Acknowledgment

The research was supervised by KAHER Institute of Physiotherapy Belgaum, India. The authors sincerely thank all the participants of this research for their valuable time and cooperation.

References

1) Kini KV, Rathod D, Kumar A. Comparison of Muscle Energy Technique vs Mulligan to Improve Gird in District Level Cricket Bowlers. *International Journal of Health Sciences and Research*. 2021;11(5):88–93. https://doi.org/10.52403/ijhsr.20210513.
2) Luigi AJD, Raum G, King BW, Bowers RL. Osteopathic approach to injuries of the overhead thrower's shoulder. *Journal of Osteopathic Medicine*. 2024. https://doi.org/10.1515/jom-2023-0145.
3) Mizoguchi Y, Suzuki K, Shimada N, Naka H, Kimura F, Akasaka K. Prevalence of glenohumeral internal rotation deficit and sex differences in range of motion of adolescent volleyball players: a case-control study. *Healthcare*. 2022;10(11):2263. https://doi.org/10.3390/healthcare10112263.
4) Vishwanath G. Prevalence of musculoskeletal problems in cricket players. *Int J Sci Res*. 2019;8(6):18–20.
5) Norkin CC, White DJ. Measurement of joint motion: a guide to goniometry. 5th ed. Philadelphia. FA Davis. 2016.
6) Standoli JP, Candela V, Bonifazi M, Gumina S. Glenohumeral Internal Rotation Deficit in Young Asymptomatic Elite Swimmers. *Journal of Athletic Training*. 2024;59(7):731–737. https://doi.org/10.4085/1062-6050-0263.23.
7) Reinold MM, Wilk KE, Macrina LC, Fleisig GS, Andrews JR. Changes in shoulder and elbow passive range of motion after pitching in professional baseball players. *Am J Sports Med*. 2008;36(3):523–527. https://doi.org/10.1177/0363546507308935.
8) Kibler WB, Sciascia A. Kinetic chain contributions to shoulder function in overhead athletes. *Sports Med Arthrosc Rev*. 2006;14(4):219–225. https://doi.org/10.1097/01.jsa.0000248847.12162.bf.
9) Kalo K, Vogt L, Sieland J, Banzer W, Niederer D. Injury and training history are associated with glenohumeral internal rotation deficit in youth tennis athletes. *BMC musculoskeletal disorders*. 2020;p. 1–7. https://doi.org/10.1186/s12891-020-03571-0.
10) Perumal S. Prevalence of Glenohumeral Internal Rotation Deficit in Fast Bowlers and Its Correlation with Bowling Speed. *Journal of Orthopedics and Joint Surgery*. 2024;6(1):17–19. https://doi.org/10.5005/jojs-10079-1125.
11) Doyscher RJ, Rühl L, Czichy B, Neumann K, Denecke T, Wolfarth B, et al. Bilateral glenohumeral internal rotation deficit (GIRD) in elite gymnasts. *Archives of Orthopaedic and Trauma Surgery*. 2023;143(5):2599–2608. https://doi.org/10.1007/s00402-022-04577-0.
12) Olivier B, Lala B, Gillion N. The cricketer's shoulder and injury: Asymmetries in range of movement and muscle length. *South African Journal of Physiotherapy*. 2020;76(1):1–6. https://doi.org/10.4102/sajp.v76i1.754.
13) Wilk KE, Macrina LC, Fleisig GS, Aune KT, Porterfield RA, Harker P, et al. Deficits in glenohumeral passive range of motion increase risk of shoulder injury in professional baseball pitchers: a prospective study. *The American Journal of Sports Medicine*. 2011;39(2):329–335. https://doi.org/10.1177/0363546510384223.